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(54) Cooling and removal system for injection moulded hollow bodies

(57) An injection molding machine for the production of preforms (1) of thermoplastic material, comprising a gripping hand (2) to take the preforms from the molds and bring them to a cooling plate (4) which by means of the nozzles (5) sucks up said preforms, which are cooled by heat exchange between their inner surface and the outer surface of the nozzles (5), the nozzles (5) being cooled by means of a cooling fluid circulating on the inside thereof and means being provided for rotating the plate (4) and for expelling the preforms which are collected by a conveyor belt and carried to a storage unit.

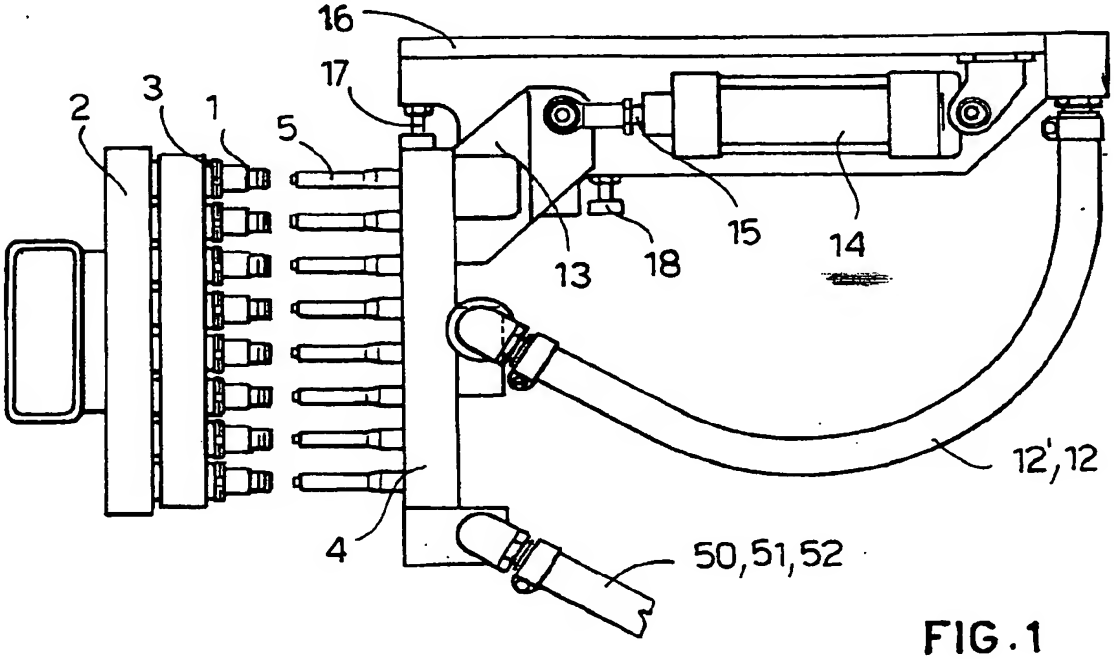

FIG.1

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cycle. Brushless motors can be used advantageously to drive the movements of the gripping hand which must be extremely precise to allow the preforms to be fitted together accurately with the respective nozzles.

[0021] When filled completely, the cooling plate is rotated into a position with the preforms facing downward and the preforms from the first group are expelled, that is, the coolest ones which have a temperature of about 15 °C which, thanks to the rapid cooling, avoids crystallization of the preform and possible deformations during transfer thereof on the conveyor belt toward a storage station; the cooling plate is then rotated again returning to the original position and the emptied group receives the n preforms of the last molding removed by the gripping hand; the cooling plate is then rotated again into the expelling position and the preforms of the second molding are expelled; the plate then returns to the starting position to receive the preforms of the last molding in the emptied section.

[0022] These cycles are repeated in sequence, allowing continuous high-speed production, for example at a rate of 15" for each production cycle.

[0023] From this brief description the advantages of the cooling and removal system for hollow bodies according to the invention are clear.

[0024] In fact eliminating the three cooling stations in sequence used in the prior art achieves a considerable saving of space, a simplification of the machine and the possibility of production changes without excessive idle times. This is translated into a cost saving due to the lower complexity of the cooling system and the possibility of simple, rapid maintenance operations.

[0025] With the cooling system according to the invention, by cooling the preform on the inside faster and more efficient cooling is achieved. This is translated into shorter production times.

[0026] Further characteristics of the invention will be made clearer by the detailed description that follows, referring to a purely exemplary and therefore non-limiting embodiment thereof, illustrated in the appended drawings, in which:

Figure 1 is a side elevation view of the cooling and removal system for injection molded hollow bodies according to the invention;

Figure 2 is a similar view to that of Figure 1 in a subsequent working stage;

Figure 3 is a front view taken from the left with respect to Figure 1, showing in particular the cooling and removal system;

Figure 4 is a plan view from above in Figure 1;

Figure 5 is a sectional view of a cooling nozzle, taken along the line A-A in Figure 2;

Figure 6 is an exploded view of the cooling nozzle in Figure 4.

[0027] The cooling and removal system according to the invention for hollow bodies 1 injection molded by means of a press not shown in the appended figures will be described with the aid of the figures.

[0028] After each molding a gripping hand 2, having an alternating rectilinear movement, is responsible for removing the preforms from the open mold.

[0029] The gripping hand consists of a substantially rectangular plate in which n cavities 3 are made to receive the n preforms 1 obtained from a molding.

[0030] A pneumatic system, sucks the preforms from the molds of the press into the cavities 3 by air suction, housing them in the bottom part, whilst the neck of the preforms is disposed on the outside (Figures 1 and 2). Retention of the preforms in the cavities 3 of the gripping hand 2 is ensured by the vacuum created therein.

[0031] High-precision driving means, such as brushless motors for example, control the movement of the gripping hand 2, to allow precise positioning thereof with respect to a cooling and removal plate 4, disposed in a vertical position for receiving the preforms, as shown in Figure 1.

[0032] The cooling plate 4 has a number of nozzles 5 that is a multiple of n (m x n) on a surface thereof facing toward the gripping hand. Said nozzles 5 have a substantially cylindrical shape with an outside diameter slightly smaller then the inside diameter of the preforms 1, so that each nozzle 5 can be inserted inside the respective preform 1 carried by the gripping hand 2.

[0033] As shown in Figures 5 and 6, the single nozzle 5 comprises a first central tubular element 11, with a substantially cylindrical shape. Said tube 11 is connected to the pneumatic system of the press for the creation of a vacuum during retention of the preforms 1 and to give off a jet of compressed air during expulsion of the preforms 1.

[0034] A second tubular element 60 having a larger inside diameter than the outside diameter of the first tube 11 is disposed coaxially to the tube 11, so as to create a hollow space or inner conduit 8 between the inner surface and the outer surface of the tube 11.

[0035] A third tubular element 70 having a larger inside diameter than the outside diameter of the tube 60 is disposed coaxially to the tubes 11 and 60, so as to form a further hollow space or outer conduit 9 between the inner surface and the outer surface of the tube 60.

[0036] The tubes 11 and 70 are blocked in the tip of the nozzle 5 by means of a threaded stopper 46 that closes the tube 70.

[0037] Inside the tube 11 is situated a needle valve 100 that closes the entrance of the tube 11 and thus shuts off the passage of compressed air when the preform 1 is detached from the tubular element 70, preventing drops in pressure and thus allowing the compressed air to be available for the preforms not yet detached

Step 6

[0056] The linear actuator 14 which causes rotation of the plate 4 bringing it into its horizontal expelling position is activated; the pneumatic system that sends compressed air to the second section C through the conduit 51 is activated causing expulsion of the preforms from said section.

Step 7

[0057] Through activation of the linear actuator 14 the plate 4 returns to its starting position and the gripping hand 2 which in the meantime has picked up a further group of n preforms from the molds fills the second section C.

Step 8

[0058] The linear actuator 14 which causes rotation of the plate 4 bringing it into its horizontal expelling position is activated, the pneumatic system that sends compressed air to the third section D through the conduit 52 is activated causing expulsion of the preforms from said section.

Step 9

[0059] Through activation of the linear actuator 14 the plate 4 returns to its starting position and the gripping hand 2 which in the meantime has picked up another n preforms from the molds fills the third section D.

Step 10

[0060] The cycle continues starting from step 4 until the machine is stopped.

Claims

1. A cooling and removal system for injection molded hollow bodies or preforms, comprising a gripping hand (2) consisting of a plate having a number n of cavities (3) equal to the number of preforms (1) produced with one molding of the injection molding machine, said gripping hand (2) being able to pick up said preforms (1) from the molds for subsequent transfer to a cooling station, characterized in that said cooling station comprises a plate (4) on the surface of which a number of nozzles (5) equal to a multiple of the number of said cavities (3) is provided, said nozzles (5) being able to receive, cool and expel said preforms (1).

2. A cooling system according to claim 1, characterized in that said plate (4) comprises a plurality m of sections (B, C, D), each with a number (n) of nozzles (5), to receive the (n) preforms of a molding of the press, said sections (B, C, D) being filled in sequence and emptied in the same order, to allow each group of preforms (1) to remain longer on the plate (4).

3. A cooling system according to claim 2, characterized in that said sections (B, C, D) comprise columns of nozzles (5) offset with respect to each other.

4. A cooling system according to one of the previous claims, characterized in that said plate (4) is rotated from a substantially vertical position able to receive the preforms (1) to a substantially horizontal position with the preforms facing downward, suitable for expulsion of said preforms (1) and vice versa.

5. A cooling system according to claim 4, characterized in that said rotation of the plate (4) is obtained by means of a linear actuator (14) acting on lever means (13) connected thereto.

6. A cooling system according to claim 1, characterized in that said nozzles (5) have a substantially cylindrical shape and have an outside diameter equal to or smaller than the inside diameter of said preforms (1) so that they can be inserted thereinto.

7. A cooling system according to claim 6, characterized in that each of said nozzles (5) comprises:

   a tube (11) connected to the pneumatic system of the machine to retain the preforms through creation of a vacuum and to expel them by means of a jet of compressed air; a tube (60) coaxial with said tube (11) and having a greater inside diameter than the outside diameter of said tube (11), so as to create a first conduit (8) for the passage of a cooling fluid between the outer surface of the tube (11) and the inner surface of the tube (60);
   A tube (70) coaxial with said tube (60), having a greater inside diameter than the outside diameter of said tube (60), so as to create a second conduit (9) for the passage of a cooling fluid between the outer surface of the tube (60) and the inner surface of the tube (70), so as to ensure cooling of the outer surface of said tube (70) which comes into contact with the inner surface of the preform (1);
   a needle valve (100) placed inside the tube (11), able to shut off the passage of compressed air when the preform (1) has been detached from the tubular element (70).

8. A cooling system according to claim 7, characterized in that at least one conduit (45) is provided in said cooling and removal plate (4) to connect said

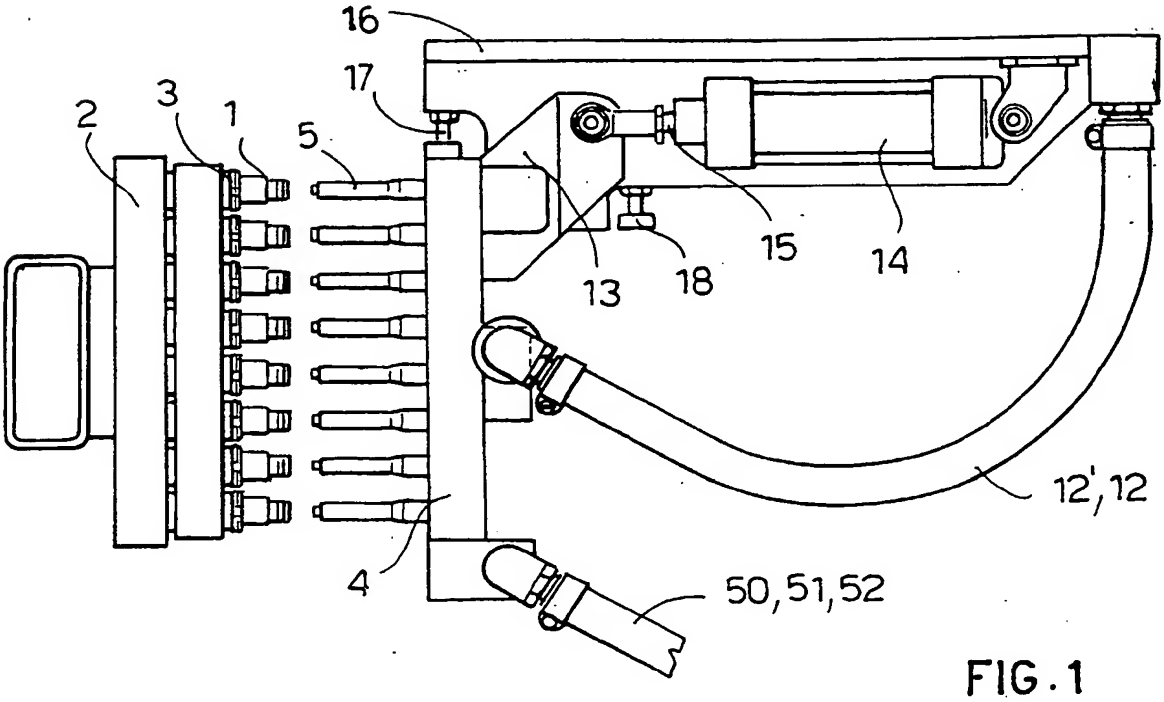


FIG. 1

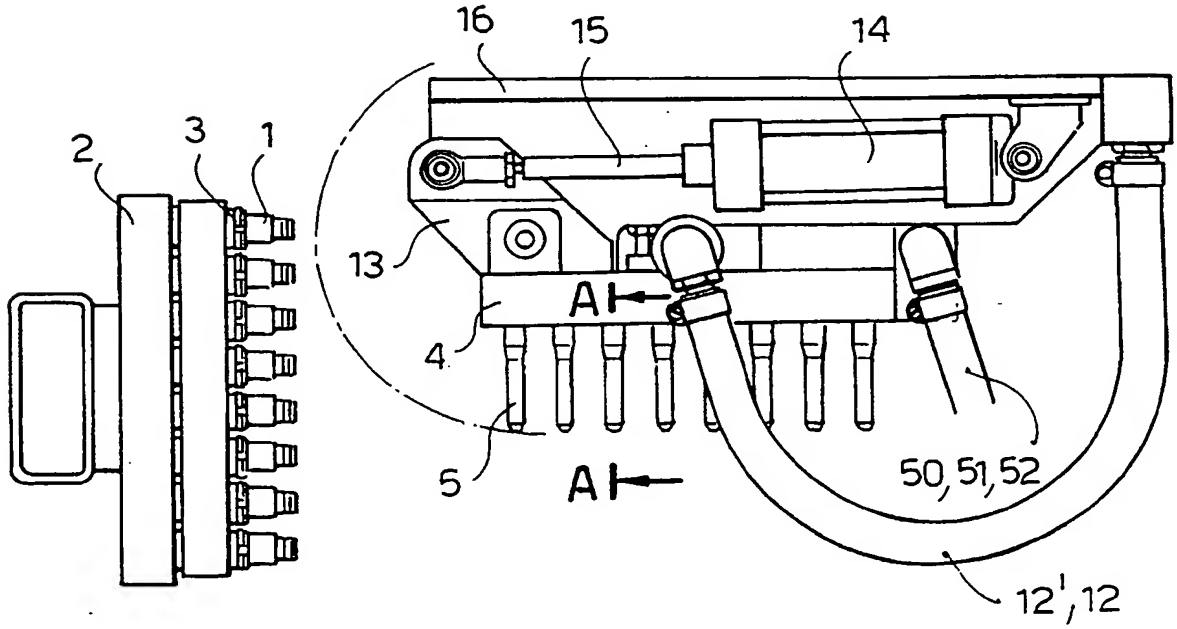


FIG. 2

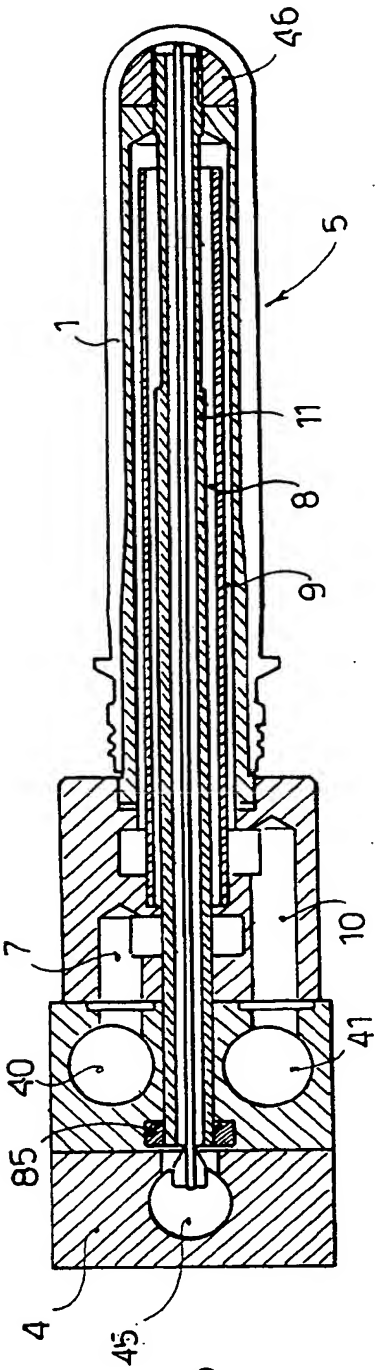
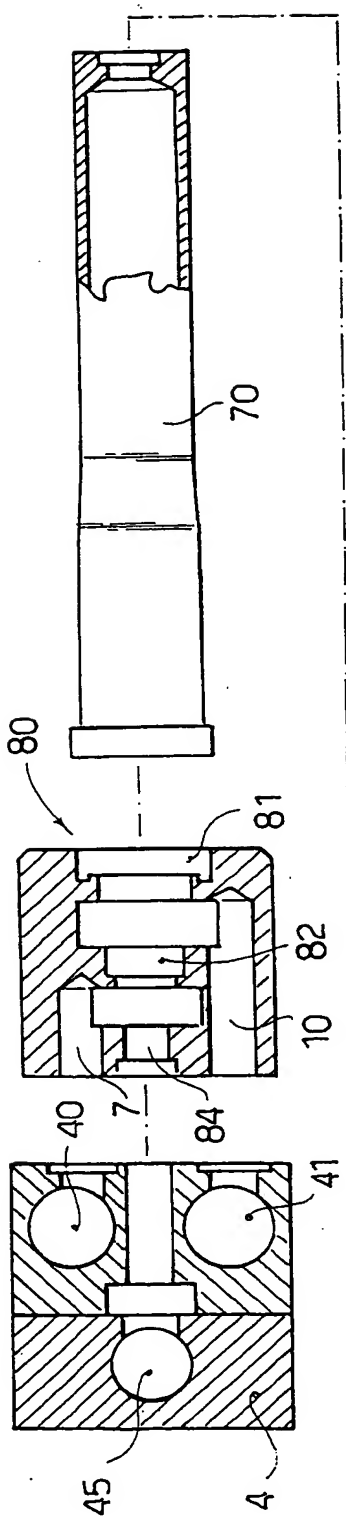


FIG.5



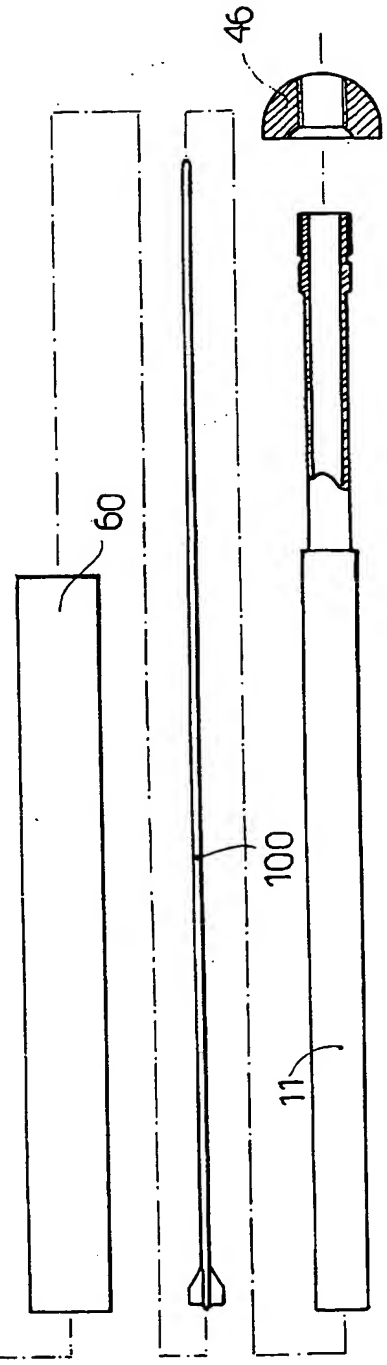


FIG.6

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 98 11 9084

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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21-05-1999

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0158105 A	16-10-1985	FR 2561166 A	20-09-1985
		AT 27689 T	15-06-1987
		CA 1263004 A	21-11-1989
		DE 3508997 A	10-10-1985
		JP 1731619 C	29-01-1993
		JP 4018524 B	27-03-1992
		JP 60212324 A	24-10-1985
		US 4592719 A	03-06-1986
US 5114327 A	19-05-1992	US 5338172 A	16-08-1994
		US 5514309 A	07-05-1996
		US 5232641 A	03-08-1993
EP 0718084 A	26-06-1996	US 5702734 A	30-12-1997
		BR 9505950 A	23-12-1997
		CN 1139040 A	01-01-1997
		JP 8252845 A	01-10-1996
		US 5837299 A	17-11-1998
US 4721452 A	26-01-1988	AT 98155 T	15-12-1993
		CA 1287958 A	27-08-1991
		DE 3886076 D	20-01-1994
		DE 3886076 T	05-05-1994
		EP 0283644 A	28-09-1988
		ES 2049222 T	16-04-1994
		GR 3021455 T	31-01-1997
		JP 1717712 C	14-12-1992
		JP 4004129 B	27-01-1992
		JP 63256413 A	24-10-1988
		US RE33237 E	19-06-1990
US 5631030 A	20-05-1997	NONE	

EPO FORM P0459

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